



[0044]

Claims

1. A vibration damper for damping torsional and bending vibrations in a rotating shaft having an axis of rotation, the vibration damper comprising:  
  
a hub adapted to be coupled to the shaft for rotational movement therewith;  
  
an inertia element concentric with the hub; and  
  
an elastic element adapted to non-rigidly couple the hub and the inertia element;  
  
wherein the elastic element possesses a first shear modulus in a first direction and a second shear modulus in a second direction and wherein the first shear modulus and the second shear modulus are different.
2. The vibration damper of claim 1 wherein the elastic element comprises a composite material.
3. The vibration damper of claim 2 wherein the composite material comprises an elastomer having a plurality of fibers dispersed therein.
4. The vibration damper of claim 3 wherein the plurality of fibers are dispersed within the elastomer in a unidirectional orientation.
5. The vibration damper of claim 3 wherein the plurality of fibers are dispersed within the elastomer in a longitudinal orientation with respect to the elastic element.
6. The vibration damper of claim 3 wherein the plurality of fibers are dispersed within the elastomer in an axial orientation that is substantially parallel to the axis of rotation.
7. The vibration damper of claim 3 wherein the plurality of fibers are dispersed within the elastomer in a radial orientation with respect to the axis of rotation.
8. The vibration damper of claim 1 wherein a first surface located on the inertia element is spaced radially outwardly from a second surface located on the hub, and wherein the elastic element is located between the first surface and the second surface.

9. The vibration damper of claim 1 wherein an outer surface of the inertia element is adapted to receive a power-transmitting belt.
10. The vibration damper of claim 1 wherein a first surface located on the hub is spaced radially outwardly from a second surface located on the inertia element, and wherein the elastic element is located between the first surface and the second surface.
11. The vibration damper of claim 1 wherein an outer surface of the hub is adapted to receive a power-transmitting belt.
12. In a vibration damper for a rotating shaft having an axis of rotation, the vibration damper having a hub and an inertia element, an elastic element for controlling torsional and bending vibrations in the rotating shaft, the elastic element comprising:
  - a composite material possessing a first shear modulus in a first direction and a second shear modulus in a second direction;
  - wherein the first shear modulus and the second shear modulus are different; and
  - wherein the elastic element is adapted to non-rigidly couple the hub and the inertia element of the vibration damper.
13. The elastic element of claim 12, wherein the composite material comprises an elastomer having a plurality of fibers dispersed therein.
14. The elastic element of claim 13, wherein the plurality of fibers are dispersed within the elastomer in a unidirectional orientation.
15. The elastic element of claim 13, wherein the plurality of fibers are dispersed within the elastomer in a longitudinal orientation with respect to the elastic element.
16. The elastic element of claim 13, wherein the plurality of fibers are dispersed within the elastomer in an axial orientation that is substantially parallel to the axis of rotation.
17. The elastic element of claim 13, wherein the plurality of fibers are dispersed within the elastomer in a radial orientation with respect to the axis of rotation.

18. The elastic element of claim 13 wherein the plurality of fibers are dispersed within the elastomer in the first direction.

19. The elastic element of claim 13 wherein the plurality of fibers are dispersed within the elastomer in an orientation perpendicular to the second direction.

20. The elastic element of claim 18 wherein the plurality of fibers are dispersed within the elastomer in an orientation perpendicular to the second direction.

21. A method of manufacturing a vibration damper used to control bending vibrations and torsional vibrations in a rotating shaft, the method comprising the steps of:

providing a hub that is adapted to be coupled to the rotating shaft for rotational motion therewith;

providing an inertia element that is concentric with the hub;

providing an elastic element that possesses a first shear modulus in a first direction and a percentage of fibers dispersed within the elastic element in a desired orientation such that the elastic element possesses a second shear modulus, which is different from the first shear modulus, in a second direction; and

operatively coupling the hub and the inertia element through the elastic element.

22. The method of claim 21 further comprising the steps of:

selecting a mass and geometry of the inertia element and a first shear modulus of the elastic element to control torsional vibrations in the rotating shaft when the hub is coupled to the shaft for rotational movement therewith; and

selecting the percentage of fibers in the elastic element and the desired orientation of the fibers in the elastic element to dampen bending vibrations in the rotating shaft.

23. The method of claim 21 further comprising the steps of:

selecting a mass and geometry of the inertia element and a first shear modulus of the elastic element to dampen bending vibrations in the rotating shaft when the hub is coupled to the shaft for rotational movement therewith; and

selecting the percentage of fibers in the elastic element and the desired orientation of the fibers in the elastic element to dampen torsional vibrations in the rotating shaft.